In 2010, September 1 was the 70th anniversary of the birth of Aleksandr Nikolaevich Vasiliev, an outstanding scientist, talented theoretical physicist, and superior teacher and educator.

Vasiliev was born 1 September 1940 in the town of Pskov. In that same town, he graduated from high school with a gold medal. While at school, he was seriously interested in chemistry, astronomy, and mathematics. In 1957, he entered the Physics Faculty of Leningrad State University, where he studied in the Theory of Nuclei and Elementary Particles Department (currently, the High Energy Physics and Elementary Particles Department), with which all his scientific and teaching career was associated. Vasiliev’s first research paper, written under the guidance of M. A. Braun, was devoted to a model of dressed particles, proposed shortly before by Yu. V. Novozhilov. In 1963, Vasiliev, working alone, turned to an extremely complicated problem belonging simultaneously to abstract mathematics, mathematical physics, and theoretical physics—the problem of a mathematically correct construction of quantum field theory and the study of its properties based on a consistent set of axioms. One of his first results was to establish a relation between the properties of Wightman functionals and the dimension of the vacuum. Shortly before that, H. J. Borchers, one of the leaders in the axiomatic approach, announced a statement that was subsequently
called the structure theorem: *Any Wightman functional can be represented as a superposition of pure functionals; such a representation is unique and corresponds to the decomposition of the field generated by this functional into irreducible fields; pure functionals correspond to theories with a unique vacuum.*

It became clear some time later that the statement was wrong in virtually all its parts. Vasiliev proved that if a Wightman functional satisfies not only the standard axioms but also an additional requirement of finite-dimensionality of the vacuum subspace, then the Borchers theorem is applicable to it in full measure. Vasiliev defended his candidate’s dissertation “Algebraic aspects of the Wightman axiomatics” in 1967 and was awarded the Lenin Komsomol Prize in 1972 for a series of works “Algebraic aspects of quantum field theory.” At the time, this was the most prestigious state prize for young researchers, which was awarded for prominent achievements in science.

In the late 1970s, Vasiliev became interested in the problem of spontaneous symmetry breaking. He investigated the property of vacuum degeneration with respect to the gauge group or the rotation group and showed that the additional degrees of freedom emerging in that case can be described by spurion creation and annihilation operators. In the same period, A. F. Yakubov and N. V. Borisov became his first students.

Vasiliev learned French from the foreign language courses that were organized at the time for specialists to teach in African countries, and he taught physics in Mali in 1964–1965. Mastering the language served him well during his trip to France in 1969–1970, where he became acquainted with a group of outstanding theorists (C. De Dominicis, E. Brezin, J. Zinn-Justin). The time spent at Saclay had a dramatic effect on Vasiliev’s research interests: he moved to the study, development, and application of functional methods of quantum field theory.

The term *functional methods* unifies a number of different mathematical techniques that allow translating the traditional operator formalism of quantum mechanics into the language of classical objects—nonlinear functionals. This language (functional integrals, generating functionals for Green’s functions and $S$-matrices, Legendre functional transformations, and variational principles) is extremely useful in writing the fundamental relations of field theory, such as the Wick theorem. The language is universal and can be used in very different areas of theoretical physics: quantum field theory, the quantum statistical physics of field and spin systems, the classical statistics of a nonideal gas, and so on. It is especially important that this technique allows going beyond the standard perturbation theory and using exact properties of the theory (for example, the convexity of the Legendre transformation), which makes it indispensable in studying anomalous solutions in the theory of phase transitions and in quantum field models with spontaneous symmetry breaking. Just the use of functional methods has allowed consistent quantization of non-Abelian gauge fields.

These methods are currently universally accepted, and they underlie the exposition of quantum field theory in modern monographs. But this was not always the case. One of Vasiliev’s first works on functional methods, discussing the idea of dynamical spontaneous symmetry breaking (which is currently known in the formulation of S. Coleman and S. Weinberg, given in their 1973 paper) was not accepted for publication, because it used an unusual formalism. The same fate befell the next work (written jointly with Yu. M. Pismak), which, fortunately, was later published in LGU Vestnik (1975). Those were pioneering investigations of axial gauges and the generating functional of the $S$-matrix in the theory of non-Abelian gauge fields.

We expound on the important works by Vasiliev on a problem that is especially relevant currently: anomalous mass generation. In those works, he considered the dependence of the vacuum energy density on bare masses and coupling constants. The form of that dependence yields circumstantial evidence for the possibility of spontaneous mass generation from an initially massless theory: the masses can occur only if this is advantageous in terms of energy, i.e., in the case where the vacuum energy density decreases as the mass increases. Models of unified weak and electromagnetic interactions of leptons with intermediate bosons with the bare masses equal to zero were also discussed. It was shown that the photon and the neutrino are...